

Activity Parameters for MOBILE6

Ed Glover

US EPA Office of Mobile Sources

Activity Distribution Types

- Start Emission Soak Distribution
- Running Loss and Exhaust Running Emission Distribution
- Hot Soak Emission Distribution
- Diurnal Emission Soak Distribution

General Information

- Distributions are Used in the Hourly Emission Calculations. These are new for MOBILE6.
- The Distributions may consist of:
 - Soak Durations
 - Time of Soak
 - Trip Lengths
 - Trip Durations
 - Timing of Trips (Before and After Soak)
- Data for these Distributions are from the Instrumented Vehicle Program in Baltimore, Spokane and Atlanta.

General Information (Con't)

- Hourly Groups
 - The 24 hour day was divided up into 14 different hourly groups.
 - Starts at 6:00 AM and proceeds hourly until 7:59:59 PM. One single nighttime group is used. It runs from 8:00 PM until 5:59:59 AM.
- Weekend versus Weekday
- Cars versus Trucks

Data Issues

- Data from the Study is Probably Not representative of Actual Fleets.
- Model does NOT Contain Information on the Relationship between Starts per Day or Soak Lengths and Their Distributions.
- User will be Given the Option to Input Alternative Parameters.
- Users are NOT Required to Input Alternative Activity Parameters.

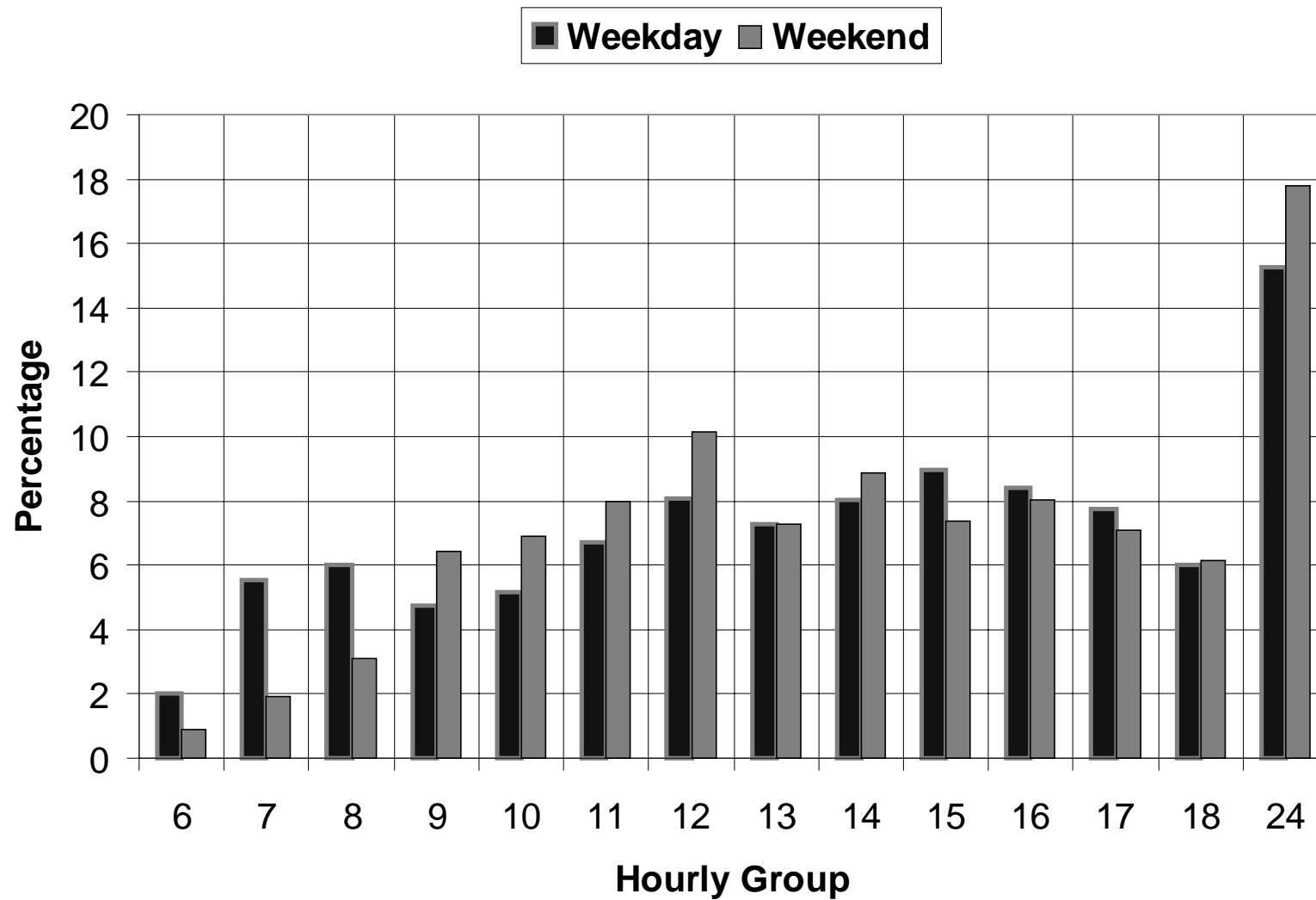
Start Emission Soak Distribution

- Important Activity Parameter for Start Emissions -
Length of Previous Soak
- Start Soak Definition (FTP)
 - Hot Start
 - Cold Start
- Average Number of Starts per Day
- Daily Distribution of Starts by Hourly Group
- Soak Distribution within Each Hourly Group
- Used in MOBILE6 to Allocate Start Emissions

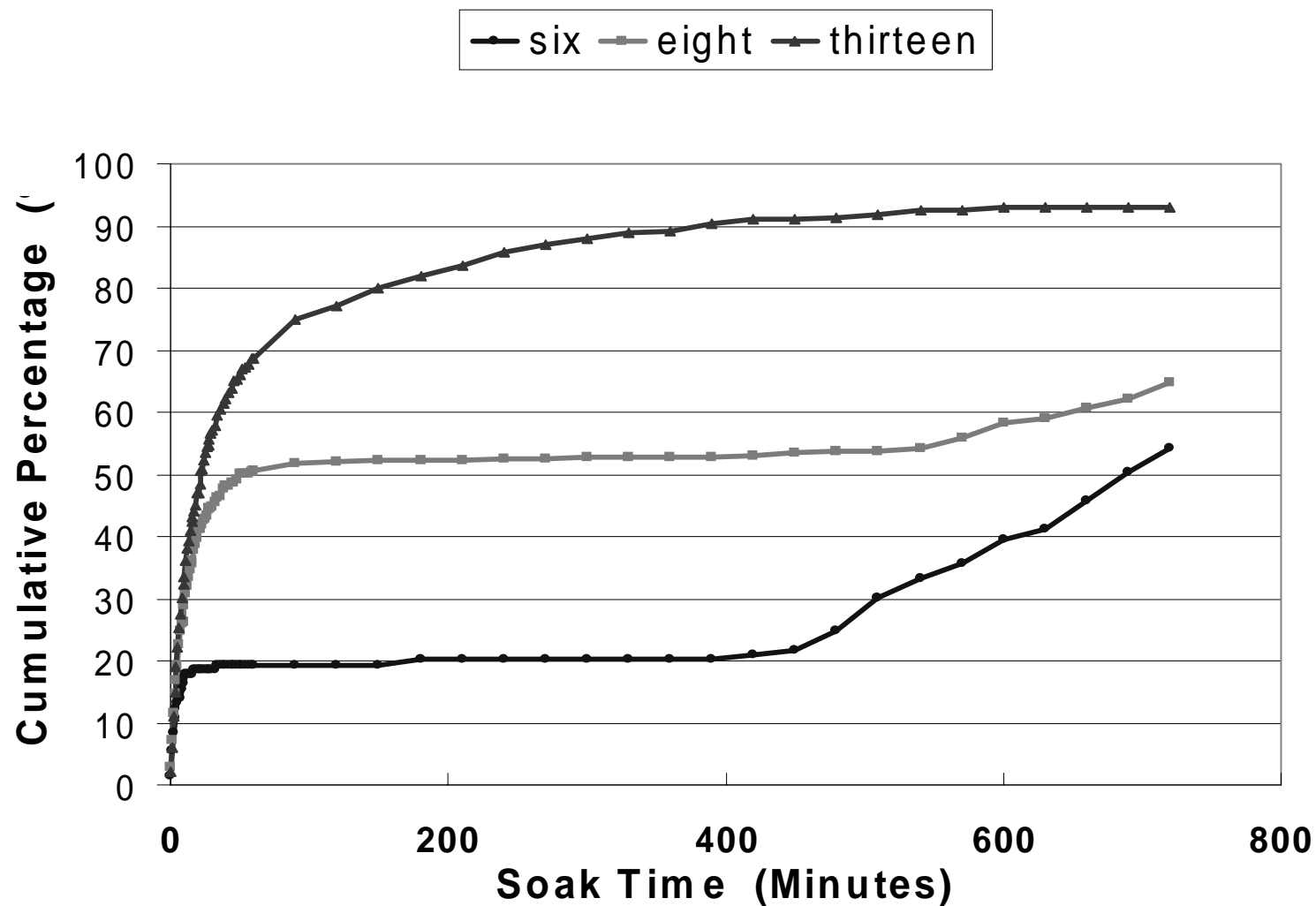
Start Emission Soak Parameters

Table 2a <u>Starts per Car per Day</u>			
<u>Cars</u>		<u>Trucks</u>	
Weekday	Weekend	Weekday	Weekend
7.28	5.41	8.06	5.68

Daily Distribution of Starts by Hourly Group



Cumulative Soak Length Distribution for Selected Hourly Groups



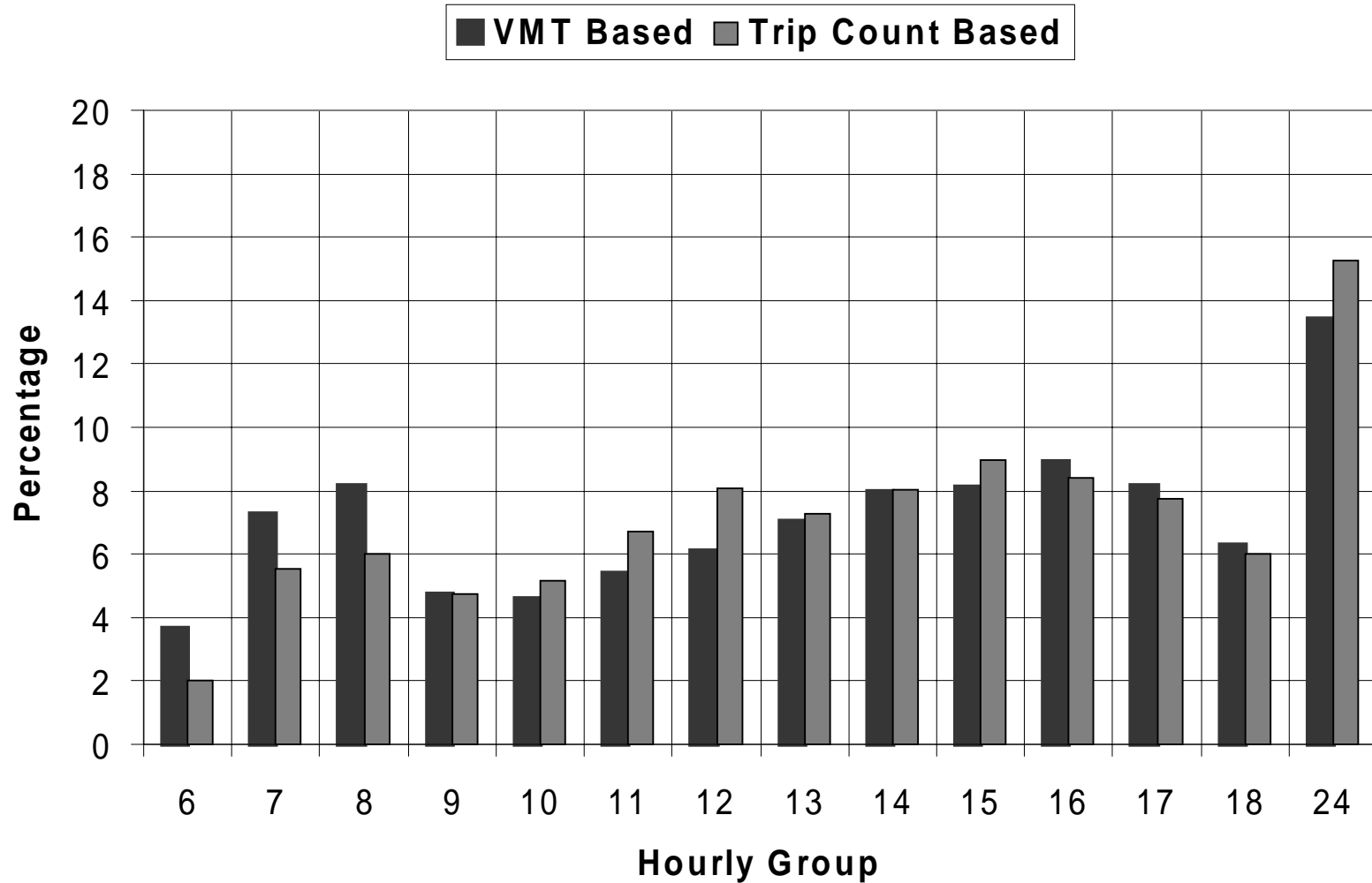
Running Loss Trip Length Distribution

- Important Activity Parameter for Running Loss Emissions - **Trip Length**
- Trips per Day Parameter is the same as Starts per Day.
- Daily Distribution of Trips by Hourly Group
 - VMT Based Distribution (Length of Trip in Miles)
 - Same Hourly Grouping as Start Activity Parameters
 - Weekday Versus Weekend Distinction

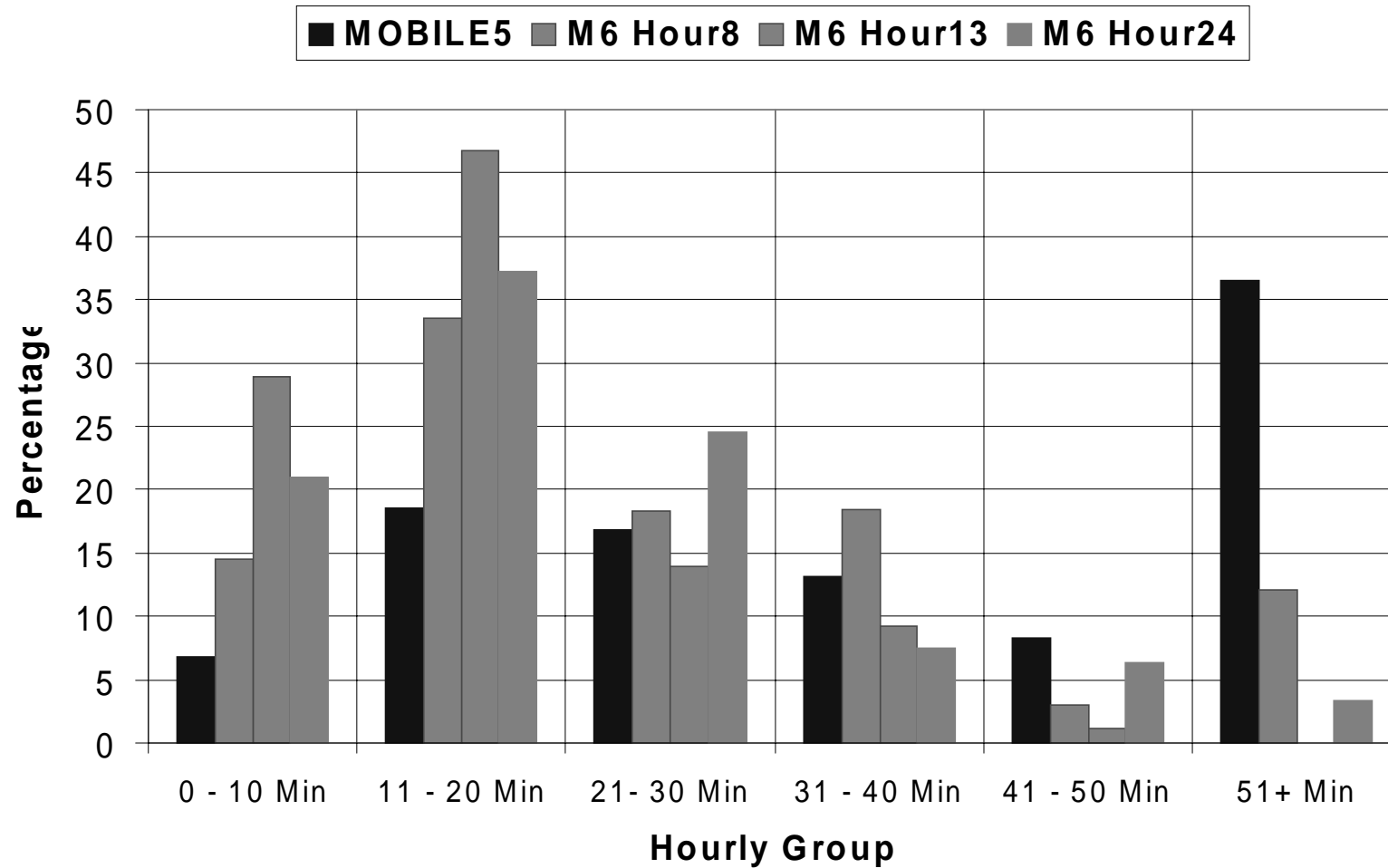
Hourly Distribution of Trips

- Hourly Distribution of Trips
 - Six Categories Based on Trip Duration in Minutes - Carry Over from MOBILE5
 - Six Categories are: 0-10 Min, 11-20 Min, 21-30 Min, 31-40 Min, 41-50 Min and 51+ Min
 - Separate Distributions for each Hourly Group - New for MOBILE6
- Methodology for Assigning Trips to the Six Hourly Categories
- Used in MOBILE6 to Calculate Running Loss Emissions for each Hourly Group.

Daily Distribution of Trips by Hourly Group



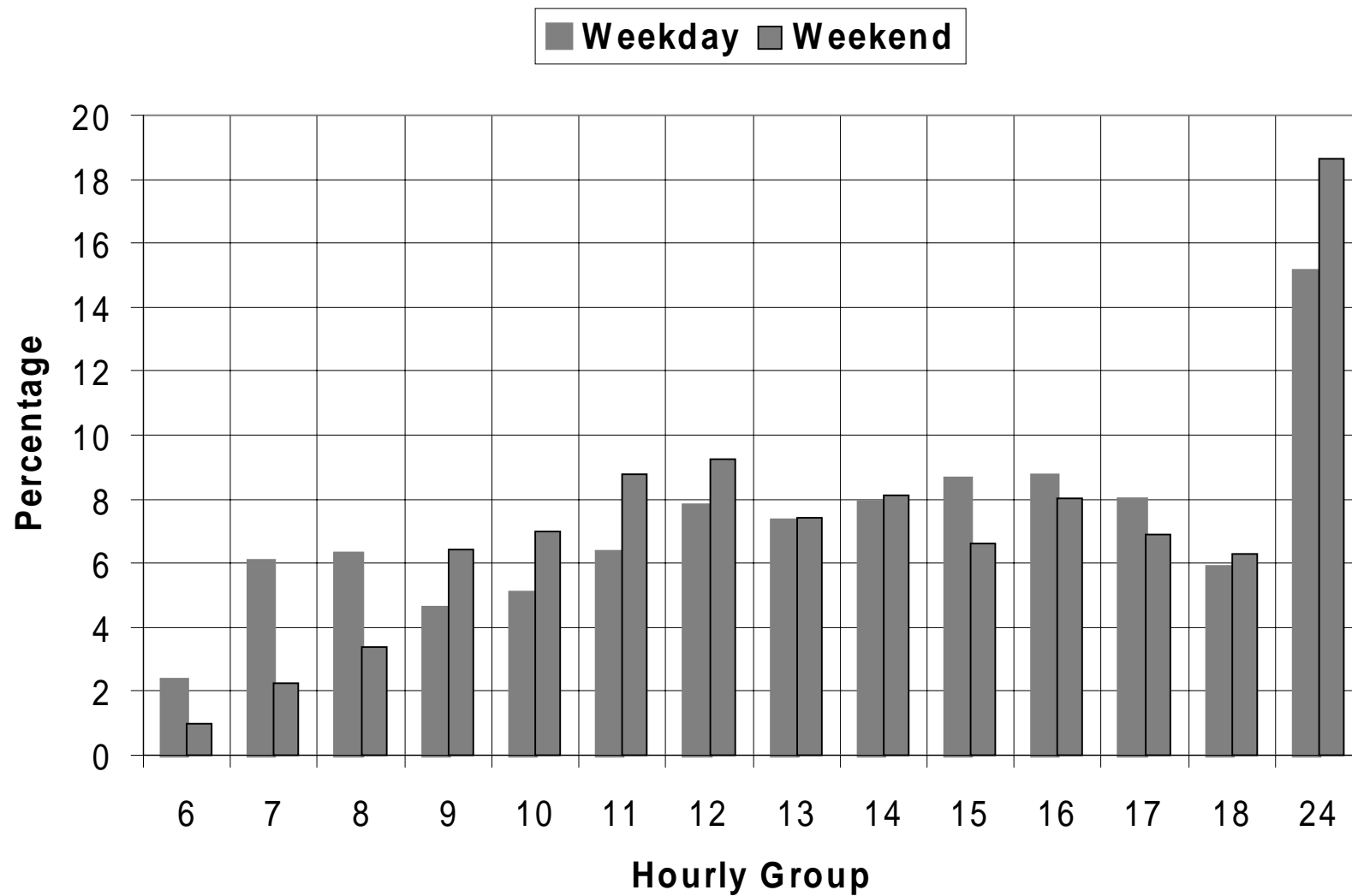
Running Loss Trip Length Distribution for Selected Hourly Groups



Hot Soak Length Distribution

- Important Activity Parameters for Hot Soak Emissions - **Soak Length and Prior Trip Duration**
- Hot Soak Definition
 - FTP Definition (One Hour in Length)
 - Four Minutes of Prior Operation Required for Valid Hot Soak
 - Four Minute Requirement Reduced the Number of Hot Soaks by 26 percent for Cars and 29 percent for Trucks.
- Daily Distribution of Valid Hot Soaks

Daily Distribution of Valid Hot Soaks



Hourly Hot Soak Distribution

- Used in MOBILE6 to Calculate Hot Soak Emissions for each Hourly Group.
- Final Methodology is Currently Undecided
 - **Method 1** - As Described in EPA Document M6.FLT.004
 - Hot Soak is Assigned to the Particular Hour in which It Began.
 - For example, if the Hot Soak Began at 7:50 AM and Lasted for 40 Minutes, Its Entire Effect would be Assigned to the 7 to 8 AM Interval.
 - **Method 2** - A Proposed Method which would be Essentially the Same Treatment for Hot Soaks as for Running Losses. This would Require Dividing the Sample into six 10 minutes Bins Based on the Length of the Hot Soak.

Soak Length Activity Factors for Diurnal Emissions

- Important Activity Parameters for Diurnal Emissions- Soak Length and Prior Day's Trip End and Time of Day to Be Evaluated.
- Vehicle Data had to be Organized on a Vehicle-Day Basis
 - Because a Diurnal is an Entire Day Event - Not a Trip/Soak Time Event.
 - For a Given Hourly Group a Vehicle is Either Having a Diurnal or it is Not having a Diurnal.
 - The concept of a Vehicle-Day Entity in the Database
 - Reduced the Effective Size of the Database
 - Could not Differentiate by Weekday and Weekend or by Vehicle Type or Model Year.
 - Same Hourly Grouping Structure was used.
 - No Diurnals were Assumed to Occur During the Nighttime hours (Group 24). Diurnals were assumed to not Occur if the Vehicle was operated the previous Night

Diurnal Activity Results

SOAKHs	6-7AM	7-8AM	8-9AM	9-10AM	10-11AM	11-12AM	12-1PM	1-2PM	2-3PM	3-4PM	4-5PM	5-6PM	6-7PM
1to2	1.27%	2.23%	5.23%	12.97%	14.88%	8.99%	7.48%	7.80%	11.14%	8.99%	10.18%	11.93%	13.84%
2to3	0.72%	1.27%	2.15%	5.09%	12.09%	13.13%	6.92%	5.41%	5.73%	8.75%	6.44%	8.27%	9.71%
3to4	1.27%	0.64%	1.19%	1.91%	4.93%	10.10%	11.30%	5.57%	4.30%	4.85%	6.52%	4.85%	7.08%
4to5	3.02%	0.95%	0.64%	1.11%	1.67%	4.77%	7.80%	10.26%	5.09%	3.98%	4.14%	5.33%	4.38%
5to6	3.50%	2.88%	0.95%	0.55%	0.95%	1.43%	4.30%	7.40%	9.39%	3.82%	3.58%	3.34%	4.85%
6to7	4.85%	2.94%	2.70%	0.72%	0.40%	0.80%	1.27%	3.90%	6.76%	8.19%	3.74%	3.34%	3.34%
7to8	5.81%	3.98%	2.63%	2.55%	0.55%	0.40%	0.64%	1.11%	3.26%	4.93%	6.05%	3.10%	3.10%
8to23	61.02%	47.81%	36.20%	29.04%	23.71%	17.90%	13.37%	9.63%	7.40%	5.89%	6.60%	7.40%	7.72%
24to47	4.93%	4.06%	3.26%	2.39%	2.07%	1.91%	1.27%	1.27%	0.95%	1.03%	0.72%	0.48%	0.48%
48to71	0.88%	0.72%	0.64%	0.55%	0.48%	0.48%	0.48%	0.40%	0.32%	0.24%	0.24%	0.16%	0.16%
72+	0.48%	0.32%	0.32%	0.16%	0.08%	0.08%	0.08%	0.08%	0.08%	0.08%	0.08%	0.08%	0.08%
running/hot soak	12.25%	32.22%	44.07%	42.95%	38.19%	40.02%	45.11%	47.18%	45.58%	49.24%	51.71%	51.71%	45.27%
TOTAL	1000%	1000%	1000%	1000%	1000%	1000%	1000%	1000%	1000%	1000%	1000%	1000%	1000%

Diurnal Activity Parameters in MOBILE6

- Integrating Diurnal Emission Factors with Diurnal Activity Parameters
- Diurnal Types
 - Null Diurnal (Running or Hot Soak Operation)
 - Interrupted Diurnal (Function of the hour that they began)
 - I-7AM, I-8AM, I-9AM, I-10AM, I-11AM, I-12AM, I-1PM, I-2PM
 - Full or One Day Diurnal (Start before 6 AM)
 - Two Day Diurnal (Start before 6 AM)
 - Three Day Diurnal (Start before 6 AM)

Summary of Diurnal Rules

Table 4 Determining the Type of Diurnal			
Rule #	Rule	Diurnal Type	Explanation
Rule 1	Soaktime < 1	Hot Soak	Hot Soak Period - No diurnal
Rule 2	Soaktime >= 1 and Soaktime < 2	Resting Loss	Vehicle Equilibrating to Ambient - No diurnal
Rule 3	Hour <= 5 (5 AM)	Resting Loss	Assume no diurnal emission from midnight to 5 am
Rule 4	Soaktime <= Hour - 13	Resting Loss	No diurnal beginning in Afternoon assume no temp rise after 3 pm.
Rule 5	Soaktime > Hour - 13 and Soaktime <= Hour - 5	Interrupted	Hot Soak ended after 6 am causes interrupted diurnal.
Rule 6	Soaktime > Hour - 5 and Soaktime <= Hour + 17	Full	Diurnal begins at 6 am. No significant diurnal on previous day.
Rule 7	Soaktime > Hour + 17 and Soaktime <= Hour + 41	Two-Day	Diurnal begins at 6 am. Significant diurnal previous day.
Rule 8	Soaktime > Hour + 41	Three-Day	Diurnal begins at 6 am. Significant diurnal previous two or more days.

Hour of Day

[illegible]

Soak Length (hour)

Further References

- Start Activity - M6.FLT.003
- Hot Soak Activity - M6.FLT.004
- Running Loss Activity - M6.FLT.005
- Diurnal Activity - M6.FLT.006
- New CARB Study and Data.